The opinion in support of the decision being entered today is *not* binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JACQUES SCHMITT

Appeal 2007-3195
Application 09/824,936
Technology Center 1700

Decided: August 17, 2007

Before EDWARD C. KIMLIN, PETER F. KRATZ, and
CATHERINE Q. TIMM, *Administrative Patent Judges*.

KRATZ, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on an appeal from the Examiner's final rejection of claims 1, 3, 4, and 6-8. We have jurisdiction pursuant to 35 U.S.C. §§ 6 and 134.

Appellants' invention is directed to a capacitively coupled RF plasma reactor. The reactor includes, *inter alia*, spaced electrodes, a radio frequency (RF) generator, at least one dielectric layer, and gas supply and evacuation features. The reactor is constructed to handle a relatively large wafer with at least one dimension of 0.7 m or more. The RF generator is required to be capable of generating frequencies greater than 13.56 MHz and the RF generator is connected to at least one electrode. Claim 1 is illustrative and is reproduced below:

1. A capacitively coupled radiofrequency plasma reactor (1, 20) comprising:

at least two electrically conductive electrodes (3, 5) spaced from each other, each electrode having an external surface (3a, 5a),

an internal process space (13) enclosed between the electrodes (3, 5),

gas providing means (7) for providing the internal process space (13) with a reactive gas,

at least one radiofrequency generator (9) for frequencies greater than 13.56 MHz connected to at least one of the electrodes (3, 5), at a connection location (9a), for generating a plasma discharge in the process space (13),

means (8) to evacuate the reactive gas from the reactor,

at least one substrate (15) with a largest dimension of at least 0.7 m, defining one boundary of the internal process space, to be exposed to the processing action of the plasma discharge, said at least one substrate (15) extending along a general surface (15a) and being arranged between the electrodes (3, 5),

characterized in that said plasma reactor (1, 20) further comprises at least one dielectric layer (11) have at least one non-planar external surface

and extending outside the internal process space, the dielectric layer being a capacitor that is electrically in series with said substrate (15) and the plasma, said dielectric layer (11) having capacitance per unit surface values which are not uniform along at least one direction of said general surface (15a), for generating a given distribution profile, for compensating a process in a non-uniform manner along said general surface (15a) in the reactor.

The Examiner relies on the following prior art references as evidence in rejecting the appealed claims:

Collins	US 5,210,466	May 11, 1993
Hanada (as translated)	JP 08-186094	Jul. 16, 1996
Shang	US 6,177,023 B1	Jan. 23, 2001
Sato	US 6,199,505 B1	Mar. 13, 2001

Claims 1, 3, 4, and 6-8 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hanada in view of Shang and Collins. Claims 1, 3, 4, and 6-8 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hanada in view of Shang and Sato.

We affirm both rejections.

The Examiner takes the position that it would have been obvious to one of ordinary skill in the art at the time of the invention to employ an RF generator that is capable of generating frequencies greater than 13.56 MHz as taught by Collins and to construct the plasma reactor so as to be capable of handling substrate work pieces of a size that encompass the representative claim 1 required substrate size (Answer 5-7 and 10-12; Collins, col. 1, ll. 31-36 and col. 4, ll. 26-47; and Shang, col. 5, ll. 58-63).

In the second stated obviousness rejection, the Examiner employs Sato in place of Collins for evidencing the prior art use of RF generators capable of generating frequencies greater than 13.56 MHz and, in addition, Sato is relied upon for teaching the treatment of wafers of a size

corresponding to the claimed wafer size requirements in a capacitively-coupled plasma reactor (Answer 7-13; Sato, col. 4, ll. 34-56; col. 8, ll. 30-48; and col. 9, ll. 12-24).

Appellant argues the rejected claims together as a group. Thus, we select claim 1 as the representative claim on which we shall decide this appeal as to both of the rejections.

Appellant does not dispute that Hanada describes or suggests a plasma reactor that includes at least two electrodes, an internal process space between the electrodes, an RF Generator, gas providing and evacuation devices, a substrate, and a dielectric layer that corresponds to these reactor features as called for in representative claim 1, except for explicitly disclosing that the RF generator is capable of generating frequencies above 13.56 MHz, and that the reactor is capable of handling a substrate having "a largest dimension of at least 0.7m" as required by representative claim 1 (Br. 7-8).[1]

Hence, the issues before us are: Has Appellant established reversible error in one or both of the Examiner's stated obviousness rejections based on the arguments and/or evidence submitted in the Briefs respecting the claim requirements for an RF generator capable of generating frequencies above 13.56 MHz and/or a plasma reactor capable of handling a large dimensioned substrate? We answer these questions in the negative and affirm the Examiner's rejections for substantially the reasons stated in the final rejection and Answer. We add the following for emphasis.

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[1] Arguments not made in the Briefs are waived. *See* 37 C.F.R. § 41.37(c)(vii) (2006).

Under 35 U.S.C. § 103, the factual inquiry into obviousness requires a determination of: (1) the scope and content of the prior art; (2) the differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) any secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18, 148 USPQ 459, 467 (1966). "[A]nalysis [of whether the subject matter of a claim is obvious] need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *KSR Int'l Co. Teleflex, Inc.*, 127 S. Ct. 1727, 1741, 82 USPQ2d 1385, 1396 (2007) *quoting In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006). *See DyStar Textilfarben GmBH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1361, 80 USPQ2d 1641, 1645 (Fed. Cir. 2006)("The motivation need not be found in the references sought to be combined, but may be found in any number of sources, including common knowledge, the prior art as a whole, or the nature of the problem itself."). The analysis supporting obviousness, however, should be made explicit and should "identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements" in the manner claimed. *KSR*, 127 S. Ct. at 1741, 82 USPQ2d at 1396. "The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *KSR*, 127 S. Ct. at 1739, 82 USPQ2d at 1395).

Here, Appellant's assertions of a lack of motivation and/or reasonable expectation of success for the use of a RF generator capable of providing

frequencies greater than 13.56 MHz and/or the provision for a large substrate in the plasma reactor of Hanada based on the combined teachings of the applied references as utilized in either of the stated rejections is not persuasive for reasons stated by the Examiner in the Answer. To begin with, representative claim 1 is not drawn to a method but rather an apparatus. Thus, the lack of suggestion/motivation argument before us is more properly focused on whether or not it would have been obvious to furnish the reactor of Hanada with the capability of handling substrate work pieces with a dimension of 0.7m or larger and with an RF generator with the capability of generating frequencies as claimed.

With regard to these matters, it is instructive to note that Hanada does not strictly limit the radio frequency generation capacity of the RF generator employed therein to one that can only generate frequencies of 13.56 MHz or less. Rather, Hanada presents several frequencies that the RF generator can be designed to produce as examples rather than by way of furnishing an upper limit for the frequency that the RF generator can produce (Hanada, ¶¶ 0005 and 0019). Thus, Hanada alone, or in combination with either Collins or Sato, would have led one of ordinary skill in the art upon routine experimentation to select and employ an RF generator with the capacity to generate frequencies higher than the exemplified 13.56 MHz frequency; that is, an RF generator which would correspond to the RF generator required by representative claim 1.

Furthermore, and while not required for the propriety of the Examiner's first stated rejection for reasons stated above, we note that the teachings of Collins respecting higher than 13.56 MHz RF generator

capacity is not limited to transmission line structures and such teaching is not inapplicable to capacitively coupled generators, as argued (Br. 8 and 9). In this regard, Collins expressly teaches that prior art semi-conductor plasma apparatus, which apparatus one of ordinary skill in the art would have understood to include capacitively-coupled systems, employs RF generators that produce frequencies as required by representative claim 1 (Collins, col. l, ll. 31-36). Moreover, Appellant's argument with respect to the limited degree of commercial success using RF generators producing higher than 50 MHz in semi-conductor processes prior to the Collins invention, as reported in the Background of Invention section of the U.S. Patent, is off base for several reasons. Representative claim 1 does not require higher than 50 MHz generation capacity. Also, Appellant acknowledges the prior art use of RF frequency values higher than 13.56 MHz Specification 2).[2] Furthermore, Appellant's argument is premised on the state of the art without the contribution of Collins and the other applied references thereto. As such, these arguments are not indicative, much less convincing, of the presence of reversible error in the Examiner's first stated rejection.

Appellant's additional arguments against a modification to the apparatus of Hanada for processing wafers of a 0.7m or larger dimension treats the teachings of Shang as if applied alone (Br. 10-11). However, it is

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[2] It is axiomatic that admitted prior art, including prior art found in an applicant's Specification, may be used in determining the patentability of a claimed invention, and that consideration of the prior art cited by the Examiner may include consideration of the admitted prior art found in the Specification. *In re Nomiya,* 509 F.2d 566, 570-571, 184 USPQ 607, 611-612 (CCPA 1975); *In re Davis,* 305 F.2d 501, 503, 134 USPQ 256, 258 (CCPA 1962).

well settled that the test for combining references is not what the individual references suggest, as if applied alone. Rather, the test is what the combined teachings of those references would have suggested to those of ordinary skill in the art. *In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981). *See also, In re Sneed*, 710 F.2d 1544, 1550, 218 USPQ 385, 389 (Fed. Cir. 1983) ("[I]t is not necessary that the inventions of the references be physically combinable to render obvious the invention under review.").

Here, we agree with the Examiner that Appellant's arguments are not persuasive of any reversible error in the Examiner's first stated rejection (Answer 11-12). One of ordinary skill in the art would have been led to construct the apparatus of Hanada to handle available substrate sizes that would need to be processed, including relatively large substrates, including substrates of a dimension corresponding to the claim 1 dimension as disclosed by Shang.

Moreover, we note that Hanada provides for homogenous treatment of wafers using high plasma densities (high RF frequencies) by employing an insulating capacitor associated with the lower electrode (Hanada, ¶¶ 16-20). Given this teaching of Hanada, Appellant's argument to the effect that non-uniformities would not be compensated for if the proposed modifications were made ("standing wave effect") are not found persuasive (Br. 11; Reply Br. 5-6). Moreover, we note that Appellant's argument concerning this lack of expectation of success in a scale up to handle larger substrates is not buttressed by any persuasive evidence.[3]

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[3] See Appellant's Evidence Appendix attached to the Brief wherein no evidence is identified. Also, we agree with the Examiner's reasoning in

For the above reasons and for the reasons set forth in the Answer and Final Office Action, we do not find the substantially similar arguments made against the Examiner's second stated rejection persuasive of any reversible error therein (Br. 11-15 and Reply Br. 6-8). In this regard and as noted above, the second stated obviousness rejection differs from the first stated obviousness rejection in the employment of Sato instead of Collins as one of the applied secondary references. Indeed, Sato references the disclosure of Collins (U.S. Patent No. 5,210,466 (Sato; col. 1, l. 32 – col. 2, l. 43)). Moreover, as explained by the Examiner in the Answer, one of ordinary skill in the art would have expected that the shape of the dielectric layer and lower electrode of Hanada would forestall problems with respect to non-uniformities due to any standing wave effect. Thus, Appellant's argument pertaining to this matter has not been established to be a disincentive or teaching away from for the modification of Hanada as proposed by the Examiner (Answer 12).

We are cognizant of Appellant's reference to page 2 of the Specification for a discussion of a non-uniformity problem at higher RF frequencies and during large substrate size processing (Reply Br. 2, 5, and 7). However, the Examiner has repeatedly addressed this argued problem that may be faced by a skilled artisan upon scale up in the Final Office Action and the Answer by noting the teachings of Hanada respecting the shape of the lower electrode and dielectric layer associated therewith as

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response to substantially the same arguments as presented in a declaration form by the inventor (Final Office Action 9-11). The declaration itself has not been relied upon in the Briefs; hence, it is not before us for additional review in support of Appellant's arguments made in the Briefs.

being result effective for counteracting non-uniformities. Indeed, Appellant employs a dielectric layer substantially like that disclosed by Hanada in describing their proposed solution for operating with high frequencies and large substrates (Specification 3; claim 1). Against this backdrop, such argumentation is hardly persuasive of any reversible error in either of the Examiner's obviousness rejections. Moreover, as suggested by the Examiner, the appealed subject matter, including representative claim 1, is not drawn to a process wherein large substrates and high frequencies are simultaneously employed. Rather, representative claim 1 is drawn to an apparatus that is capable of handling large work pieces (substrates) and an apparatus that requires a RF generator that is capable of producing frequencies greater than 13.56 MHz rather than a method requiring the use of high frequencies while processing a large substrate (Answer 12).

On this record, we are not persuaded of any reversible error in the Examiner's rejections based on the arguments made in the Briefs.

ORDER

The decision of the Examiner to reject claims 1, 3, 4, and 6-8 under 35 U.S.C. § 103(a) as being unpatentable over Hanada in view of Shang and Collins and to reject claims 1, 3, 4, and 6-8 under 35 U.S.C. § 103(a) as being unpatentable over Hanada in view of Shang and Sato is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

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